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FOREST AREA AND TIMBER RESOURCE STATISTICS FOR THE BOZEMAN WORKING CIRCLE, MONTANA, 1976

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ABSTRACT

Presents land area, commercial timberland area, timber inventory, and growth and mortality data based on Renewable Resources Evaluation standards.

KEYWORDS: forest surveys (regional), forest area classification, stand volume.

INTRODUCTION

A comprehensive timber resource study was conducted on State and private lands in the Bozeman Working Circle, Montana, in 1976, by the Montana Department of Natural Resources and Conservation, Division of Forestry, in cooperation with the Forest Service, Region 1, Division of State and Private Forestry, and the Intermountain Forest and Range Experiment Station.

The Bozeman Working Circle includes Gallatin, Meagher, and Park Counties (see fig. 1). The total land area is 5.0 million acres (2.0 million hectares). The Forest Service, the Bureau of Land Management, and miscellaneous Federal owners administer 2.1 million acres (0.8 million hectares) of this land. The remainder is in State and private ownership. This note presents data from State and private lands only.

Highlights show the area of commercial timberland in comparison to total forest land area, and the distribution of this area by forest type, stand-size class, and site class. Discussions of the data reliability and terminology are included. These two items should be reviewed carefully when using this information.

[1]Respectively, Supervisory Statistical Assistant and Statistical Assistant.

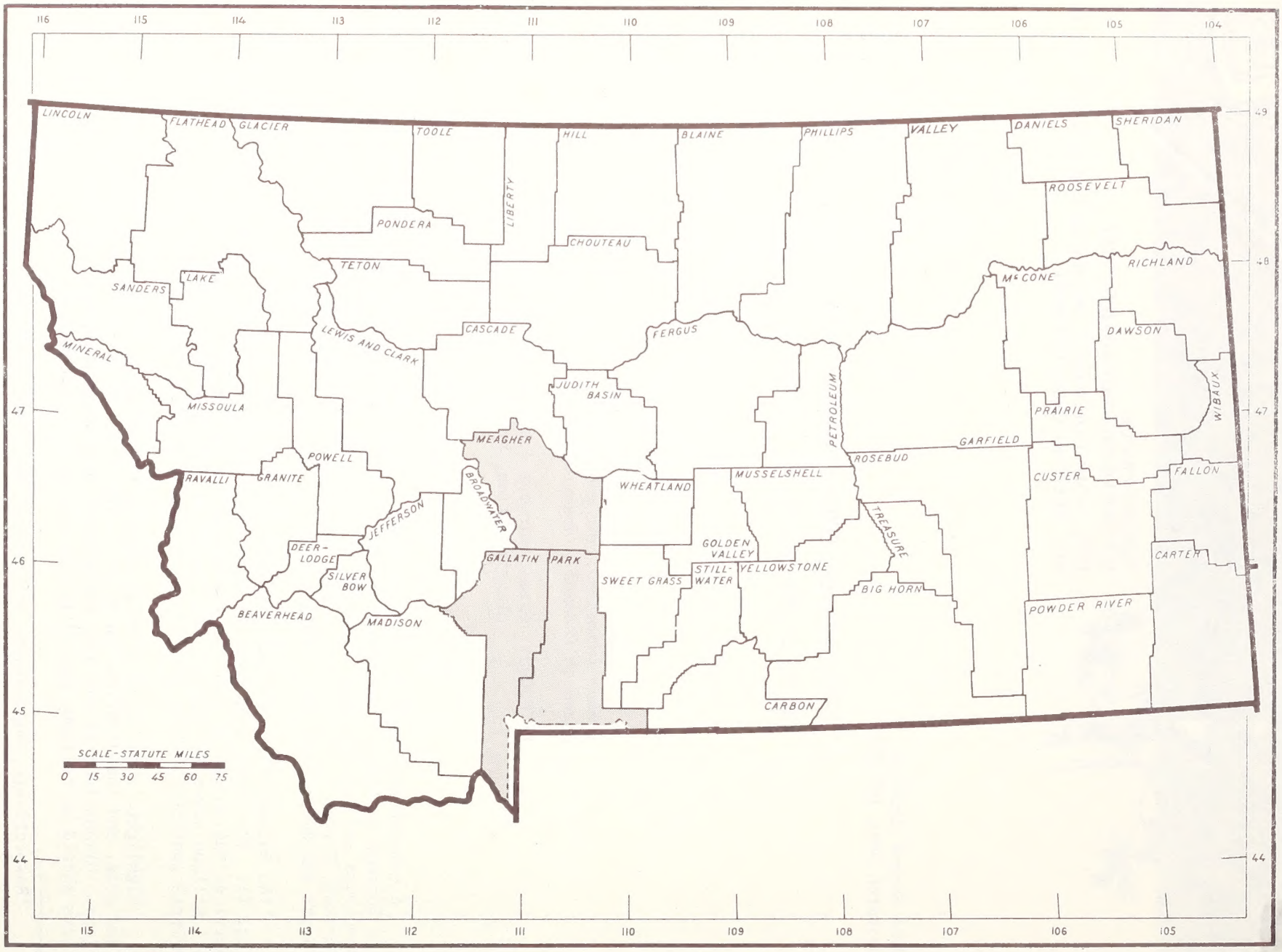

Figure 1.--Bozeman working circle, Montana.

HIGHLIGHTS

AREA

- The forest land area is 657 thousand acres (266 thousand hectares), or 22 percent of the total State and private land area in the Working Circle.
- Of the forest land, 586 thousand acres (237 thousand hectares), or 89 percent, is classified as commercial timberland.
- Private ownership accounts for 559 thousand acres (226 thousand hectares), or 95 percent, of the commercial timberland.
- The predominant forest types are Douglas-fir, lodgepole pine, and spruce-subalpine fir; they occupy 87 percent of the commercial timberland. The remaining area consists of whitebark-limber pine, ponderosa pine, juniper,[2] and hardwood forest types.
- Almost 70 percent of the commercial timberland supports sawtimber stands; poletimber stands make up 19 percent. The remainder is in sapling and seedling stands or nonstocked.
- Nearly 83 percent of the commercial timberland is in the 20 to 49 cubic-foot productivity class, 95 percent of which is privately owned.

INVENTORY

- Growing stock volume amounts to 930 million cubic feet (26 million cubic meters) with the major portion, about 67 percent, in softwood sawtimber trees.
- Rough, rotten, and salvable dead trees comprise 103 million cubic feet (3 million cubic meters), or 10 percent, of the total sound wood volume.
- About 92 percent of the 3,097 million board feet[3] of sawtimber volume is in sawtimber trees less than 23.0 inches d.b.h.
- Douglas-fir (47.6 percent) and lodgepole pine (26.6 percent) make up 74.2 percent of the growing stock volume and 73.9 percent of the sawtimber volume. Species sharing the remaining percentage are Engelmann spruce, whitebark-limber pine, subalpine fir, ponderosa pine, juniper, aspen and other hardwoods.
- Private owners control 95 percent of the softwood growing stock volume and 95 percent of the softwood sawtimber volume.

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[2]The area occupied by juniper forest type classified as commercial is so classified because the site index for other associated species on these stands (usually ponderosa pine or Douglas-fir) is high enough to indicate a potential productivity level exceeding 20 cubic feet per acre per year average annual growth, and nonstockable indicators are not present in sufficient quantities to lower the yield capability below 20 cubic feet per acre per year. Although juniper usually occurs on unproductive forest land, when it occurs in mixtures with other species on productive sites, it is reported in the commercial timberland statistics.

[3]International 1/4-inch rule.

GROWTH AND MORTALITY

- Net annual growth of growing stock totals 12,171 thousand cubic feet (345 thousand cubic meters) with 95 percent occurring in softwood species, mainly Douglas-fir, lodgepole pine, and subalpine fir. Growth and mortality were not measured for juniper trees.
- About 95 percent of the total net growth is on private lands.
- The annual mortality of 5,682 thousand cubic feet (161 thousand cubic meters) offsets 32 percent of the gross annual growth.
- Weather and unknown factors account for 75 percent of the mortality. The remainder was caused by suppression, insects, disease, and fire.
- Seventy-three percent of the mortality occurs in the lodgepole pine and Douglas-fir species.

DATA RELIABILITY

The sampling errors presented in tables 1 and 2 are in terms of one standard error--the 67 percent confidence level. Individual cells within tables should be used with caution. Some are based on small sample sizes, thus resulting in high sampling errors.

Table 1.--*Forest land area and associated sampling error percentages for the Bozeman Working Circle, 1976*

Item	Softwood types		Hardwood types		All types	
	Acres	Percent	Acres	Percent	Acres	Percent
Commercial timberland	557,242	2.7	29,055	27.3	586,297	2.6
Other forest land:						
Unproductive reserved	--	--	--	--	--	--
Unproductive nonreserved	44,823	24.5	26,156	34.3	70,979	19.2

Table 2.--*Net Volume, net annual growth and annual mortality on commercial timberland, with associated sampling error percentages for the Bozeman Working Circle, 1976*

Item	Softwoods		Hardwoods		All species	
	Volume	Percent	Volume	Percent	Volume	Percent
Volume:						
Growing stock (M cubic feet)	905,198	5.0	24,992	26.6	930,190	4.9
Sawtimber (M board feet[1])	3,056,184	6.0	40,464	31.5	3,096,648	6.0
Net Growth:						
Growing stock (cubic feet)	11,610,357	11.2	560,367	50.4	12,170,724	10.9
Sawtimber (board feet[1])	62,080,920	12.9	1,632,272	84.8	63,713,192	12.7
Mortality:						
Growing stock (cubic feet)	5,281,460	17.1	400,811	37.4	5,682,271	16.2
Sawtimber (board feet[1])	17,507,218	21.7	696,414	72.5	18,203,632	21.2

[1]International 1/4-inch rule.

TERMINOLOGY AND DATA TABLES

The following section contains definitions, taken directly from the Forest Service Forest Survey Handbook, that are relevant to the timber resource data presented in this Research Note. Forest area and timber resource data for the Bozeman Working Circle, Montana, are displayed in tables 3 through 23.

TERMINOLOGY

Land Use Classes

LAND AREA

Bureau of the Census.--The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, estuaries, and canals less than 1/8 of a statute mile in width; and lakes, reservoirs, and ponds less than 40 acres in area.

WATER

Census water.--As defined by the Bureau of Census, streams, sloughs, estuaries, and canals more than 1/8 of a statute mile in width; and lakes, reservoirs, and ponds more than 40 acres in area.

Noncensus water.--The same as defined by the Bureau of the Census, except minimum width of streams, etc., is 120 feet and minimum size of lakes, etc., is 1 acre.

Forest land.--Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use.

Commercial timberland.--Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying have the capability of producing in excess of 20 cubic feet per acre per year of industrial wood under management. Currently inaccessible and inoperable areas are included, except when the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future.)

Productive-reserved forest land.--Forest land sufficiently productive to qualify as commercial timberland, but withdrawn from timber utilization through statute, administrative designation, or exclusive use for Christmas tree production.

Other forest land.--(1) Forest land incapable of producing 20 cubic feet per acre of industrial wood under management, because of adverse site conditions; (2) unproductive-reserved forest land.

Nonforest land.--Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses.

Ownership Classes

National Forest land.--Federal lands that have been legally designated as National Forest or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III lands.

Bureau of Land Management lands.--Federal land administered by the Bureau of Land Management.

Indian lands.--Tribal lands held in fee by the Federal Government, but administered for Indian tribal groups and Indian trust allotments.

State.--Lands owned by States, or lands leased to these governmental units for 50 years or more.

PRIVATE AND OTHER

County and municipal lands.--Lands owned by counties and local public agencies or municipalities, or lands leased to these governmental units for 50 years or more.

Forest industry lands.--Lands owned by companies or individuals operating wood-using plants.

Farmer-owned lands.--Lands owned by farm operators. (Note: These exclude lands leased by farm operators from nonfarm owners, such as railroad companies and States.)

Miscellaneous Federal lands.--Federal lands other than the following: (1) National Forest lands; (2) lands administered by the Bureau of Land Management; and (3) Indian lands.

Miscellaneous private lands.--Privately owned lands other than forest industry and farmer-owned lands.

Forest Type and Tree Species

Forest types.--A classification of forest land based upon the species forming a plurality of live-tree stocking.

Forest trees.--Woody plants having a well-developed stem and usually more than 12 feet in height at maturity.

Commercial species.--Tree species presently or prospectively suitable for industrial wood products.

Softwoods.--Coniferous trees, usually evergreen, having needles or scalelike leaves.

Hardwoods.--Dicotyledonous trees, usually broad-leaved and deciduous.

Area Condition Classes

Stocking.--Stocking is an effort to express the extent to which growing space is effectively utilized by present or potential growing stock trees or commercial species. "Percent of stocking" is synonymous with "percentage of growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and stands. Basal area is used as a basis for measuring stocking.

"Stocking percentages" express current area occupancy in relation to specified standards for full stocking based on number, size, and spacing of trees considered necessary to fully utilize the forest land.

Full utilization of the site occurs over a range of basal area. Sixty percent of the normal yield table values has been used to establish the lower limit of this range, which represents full-site occupancy. This is called 100-percent stocking. The upper limit of full stocking has been set at 132 percent. Sites with less than 100-percent stocking represent understocking. Overstocking is characterized by sites with over 133 percent stocking.

Class 10.--Area fully stocked (100-132 percent) with desirable trees and not overstocked (133 percent or more).

Class 20.--Area fully stocked with desirable trees, but overstocked with all live trees.

Class 30.--Areas medium to fully stocked (60-99 percent) with desirable trees and with less than 30 percent of the area controlled by other trees and (or) inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.

Class 40.--Areas medium to fully stocked with desirable trees and with 30 percent or more of the area controlled by other trees and (or) conditions that ordinarily prevent occupancy by desirable trees.

Class 50.--Areas poorly stocked (16.7-59 percent) with desirable trees, but fully stocked with growing stock trees.

Class 60.--Areas poorly stocked with desirable trees, but with medium to full stocking of growing stock trees.

Class 70.--Areas nonstocked (less than 16.7 percent) or poorly stocked with desirable trees, and poorly stocked with growing stock trees.

Class 80.--Low-risk old-growth stands.

Class 90.--High-risk old-growth stands.

Nonstocked.--Areas less than 16.7 percent stocked with growing stock trees.

Class of Timber

Growing stock trees.--Live trees of commercial species qualifying as desirable or acceptable trees. (Note: Excludes rough, rotten, and dead trees.)

Desirable trees.--Growing stock trees (a) having no serious defect in quality limiting present or prospective use for timber products; (b) of relatively high vigor; and (c) containing no pathogens that may result in death or serious deterioration before rotation age.

Acceptable trees.--Growing stock trees that meet specified standards of size and quality, but not qualifying as desirable trees.

Rough trees.--(1) Live trees of commercial species that do not contain at least one 12-foot saw log or two noncontiguous saw logs, each 8 feet long or longer, now or prospectively, and (or) do not meet Regional specifications for freedom from defect primarily because of roughness or poor form; (2) all live trees of noncommercial species.

Rotten trees.--Live trees that do not contain at least one 12-foot saw log or two noncontiguous saw logs, each 8 feet long or longer, now or prospectively, and (or) do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cubic volume (cubic-foot basis) in a tree is rotten.

Cull.--Portions of a tree that are unusable for industrial wood products because of rot, form, or other defect.

Salvable dead trees.--Standing or down dead trees that are considered merchantable by Regional standards.

Mortality trees.--Trees, formerly growing stock, dying from natural causes during a a specified period, usually 1 year.

Saw-log portion.--That part of the bole of sawtimber trees between the stump and the saw log top. A 1-foot stump is used.

Upper-stem portion.--That part of the bole of sawtimber trees above the saw log top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs, whichever occurs first.

Tree Size Classes

Seedlings.--Live trees less than 1.0 inch in diameter at breast height.

Saplings.--Trees 1.0-4.9 inches in diameter at breast height.

Poletimber trees.--Trees at least 5.0 inches in d.b.h., but smaller than sawtimber size.

Sawtimber trees.--Trees exceeding poletimber size. In the Intermountain States, the minimum d.b.h. for softwood sawtimber is 9.0 inches, and 11.0 inches for hardwoods.

Volume

Net volume.--Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

Growing stock volume.--Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) outside bark. Net volume equals gross volume less deduction for rot and missing bole sections.

Sawtimber volume.--Net volume in board feet of sawtimber trees of commercial species. Net volume equals gross volume less deduction for rot, sweep, crook, and other defects that affect use for lumber.

Growth and Mortality

Net annual growth.--The increase in net growing stock volume of a specified size class for a specific year. (Note: Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to its end, plus net volume of trees reaching the size class during the year, minus the net volume of trees that died during the year, minus the net volume of trees that became rough or rotten trees during the year.)

Mortality.--Number or sound-wood volume of growing stock trees dying from natural causes during a specified period.

Site

Site class.--A classification of forest land in terms of inherent capacity to grow crops of industrial wood.

Site classifications are based upon the mean net annual growth of growing stock (not including thinnings or mortality loss) attainable at culmination of mean net annual growth over age. Height-age relationships are usually used as indicators of the specified volume-site class.

Stand-Size Classes

Sawtimber stands.--Stands at least 16.7 percent stocked with growing stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.--Stands at least 16.7 percent stocked with growing stock trees in which half or more of this stocking is in poletimber and (or) sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.--Stands at least 16.7 percent stocked with growing stock trees in which more than half of the stocking is saplings and (or) seedlings.

Nonstocked land.--Commercial timberland less than 16.7 percent stocked with growing stock trees.

Table 3.--*Total area in the Bozeman Working Circle by ownership class, 1976*

Ownership class	Acres	Hectares
National Forest	1,840,447	744,806
Bureau of Land Management	38,777	15,693
National Park Service[1]	167,710	67,870
State	202,807	82,073
Private and other	2,720,499	1,100,951
Total land area	4,970,240	2,011,393
Census water	19,200	7,770
Gross area[2]	4,989,440	2,019,163

[1]Not included with Miscellaneous Federal (a category of private and other) for purposes of clarity.

[2]U.S. Bureau of the Census, land and water area of the United States, 1970.

Table 4.--*Land area in the Bozeman Working Circle by major land class and ownership class, 1976*

Land class	Ownership class			
	State		Private[1]	
	Acres	Hectares	Acres	Hectares
Commercial timberland	27,091	10,963	559,206	226,304
Productive reserved	--	--	--	--
Other forest land:				
Unproductive reserved	--	--	--	--
Unproductive nonreserved	3,826	1,548	67,153	27,176
Total forest land	30,917	12,511	626,359	253,480
Nonforest land	171,890	69,562	2,094,140	847,471
Total land area	202,807	82,073	2,720,499	1,100,951

[1]On this and all later tables, the private ownership category includes a small portion of County and municipal ownership.

Table 5.--*Area of commercial timberland in the Bozeman Working Circle by forest type, stand-size class, and site class, State owned, 1976*

Forest type and stand-size class	Site class					Total acres
	165+	120-164	85-119	50-84	20-49	
				Acres		
Douglas-fir:						
Sawtimber	--	--	--	2,603	9,297	11,900
Poletimber	--	--	--	--	2,421	2,421
Sapling and seedling	--	--	--	--	268	268
Nonstocked	--	--	--	--	--	--
Total	--	--	--	2,603	11,986	14,589
Ponderosa pine:						
Sawtimber	--	--	--	--	613	613
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	613	613
Lodgepole pine:						
Sawtimber	--	--	--	552	2,376	2,928
Poletimber	--	--	--	242	1,615	1,857
Sapling and seedling	--	--	--	--	195	195
Nonstocked	--	--	--	--	353	353
Total	--	--	--	794	4,539	5,333
Whitebark-limber pine:						
Sawtimber	--	--	--	190	1,001	1,191
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	163	163
Nonstocked	--	--	--	--	--	--
Total	--	--	--	190	1,164	1,354
Spruce-subalpine fir:						
Sawtimber	--	--	--	988	1,407	2,395
Poletimber	--	--	--	119	--	119
Sapling and seedling	--	--	--	--	336	336
Nonstocked	--	--	--	--	--	--
Total	--	--	--	1,107	1,743	2,850
Juniper:						
Sawtimber	--	--	--	--	48	48
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	195	195
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	243	243
Aspen:						
Sawtimber	--	--	--	--	--	--
Poletimber	--	--	--	--	780	780
Sapling and seedling	--	--	--	550	259	809
Nonstocked	--	--	--	--	--	--
Total	--	--	--	550	1,039	1,589
Cottonwood:						
Sawtimber	--	--	--	--	260	260
Poletimber	--	--	--	--	260	260
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	520	520
All types:						
Sawtimber	--	--	--	4,333	15,002	19,335
Poletimber	--	--	--	361	5,076	5,437
Sapling and seedling	--	--	--	550	1,416	1,966
Nonstocked	--	--	--	--	353	353
Total	--	--	--	5,244	21,847	27,091

Table 6.--*Area of commercial timberland in the Bozeman Working Circle by forest type, stand-size class, and site class, private owned, 1976*

Forest type and stand-size class	Site class					Total acres
	165+	120-164	85-119	50-84	20-49	
				Acres		
Douglas-fir:						
Sawtimber	--	--	--	45,699	199,712	245,411
Poletimber	--	--	--	--	54,170	54,170
Sapling and seedling	--	--	--	--	6,991	6,991
Nonstocked	--	--	--	--	3,871	3,871
Total	--	--	--	45,699	264,744	310,443
Ponderosa pine:						
Sawtimber	--	--	--	--	14,290	14,290
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	14,290	14,290
Lodgepole pine:						
Sawtimber	--	--	--	11,074	42,391	53,465
Poletimber	--	--	--	3,502	28,657	32,159
Sapling and seedling	--	--	--	--	11,472	11,472
Nonstocked	--	--	--	3,870	6,875	10,745
Total	--	--	--	18,446	89,395	107,841
Whitebark-limber pine:						
Sawtimber	--	--	--	3,373	17,436	20,809
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	3,502	3,502
Nonstocked	--	--	--	--	--	--
Total	--	--	--	3,373	20,938	24,311
Spruce-subalpine fir:						
Sawtimber	--	--	--	17,412	32,151	49,563
Poletimber	--	--	--	4,002	--	4,002
Sapling and seedling	--	--	--	--	10,869	10,869
Nonstocked	--	--	--	--	3,871	3,871
Total	--	--	--	21,414	46,891	68,305
Juniper:						
Sawtimber	--	--	--	--	3,340	3,340
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	3,730	3,730
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	7,070	7,070
Aspen:						
Sawtimber	--	--	--	--	--	--
Poletimber	--	--	--	--	9,755	9,755
Sapling and seedling	--	--	--	7,110	3,577	10,687
Nonstocked	--	--	--	--	--	--
Total	--	--	--	7,110	13,332	20,442
Cottonwood:						
Sawtimber	--	--	--	--	3,252	3,252
Poletimber	--	--	--	--	3,252	3,252
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	6,504	6,504
All types:						
Sawtimber	--	--	--	77,558	312,572	390,130
Poletimber	--	--	--	7,504	95,834	103,338
Sapling and seedling	--	--	--	7,110	40,141	47,251
Nonstocked	--	--	--	3,870	14,617	18,487
Total	--	--	--	96,042	463,164	559,206

Table 7.--*Area of commercial timberland in the Bozeman Working Circle by forest type, stand-size class, and site class, summary--State and private, 1976*

Forest type and stand-size class	Site class					Total acres
	165+	120-164	85-119	50-84	20-49	
				Acres		
Douglas-fir:						
Sawtimber	--	--	--	48,302	209,009	257,311
Poletimber	--	--	--	--	56,591	56,591
Sapling and seedling	--	--	--	--	7,259	7,259
Nonstocked	--	--	--	--	3,871	3,871
Total	--	--	--	48,302	276,730	325,032
Ponderosa pine:						
Sawtimber	--	--	--	--	14,903	14,903
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	14,903	14,903
Lodgepole pine:						
Sawtimber	--	--	--	11,626	44,767	56,393
Poletimber	--	--	--	3,744	30,272	34,016
Sapling and seedling	--	--	--	--	11,667	11,667
Nonstocked	--	--	--	3,870	7,228	11,098
Total	--	--	--	19,240	93,934	113,174
Whitebark-limber pine:						
Sawtimber	--	--	--	3,563	18,437	22,000
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	3,665	3,665
Nonstocked	--	--	--	--	--	--
Total	--	--	--	3,563	22,102	25,665
Spruce-subalpine fir:						
Sawtimber	--	--	--	18,400	33,558	51,958
Poletimber	--	--	--	4,121	--	4,121
Sapling and seedling	--	--	--	--	11,205	11,205
Nonstocked	--	--	--	--	3,871	3,871
Total	--	--	--	22,521	48,634	71,155
Juniper:						
Sawtimber	--	--	--	--	3,388	3,388
Poletimber	--	--	--	--	--	--
Sapling and seedling	--	--	--	--	3,925	3,925
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	7,313	7,313
Aspen:						
Sawtimber	--	--	--	--	--	--
Poletimber	--	--	--	--	10,535	10,535
Sapling and seedling	--	--	--	7,660	3,836	11,496
Nonstocked	--	--	--	--	--	--
Total	--	--	--	7,660	14,371	22,031
Cottonwood:						
Sawtimber	--	--	--	--	3,512	3,512
Poletimber	--	--	--	--	3,512	3,512
Sapling and seedling	--	--	--	--	--	--
Nonstocked	--	--	--	--	--	--
Total	--	--	--	--	7,024	7,024
All types:						
Sawtimber	--	--	--	81,891	327,574	409,465
Poletimber	--	--	--	7,865	100,910	108,775
Sapling and seedling	--	--	--	7,660	41,557	49,217
Nonstocked	--	--	--	3,870	14,970	18,840
Total	--	--	--	101,286	485,011	586,297

Table 8.--*Area of commercial timberland in the Bozeman Working Circle by stand volume and ownership classes, 1976*

Stand volume per acre[1]	Ownership class		
	State	Private	State and private
	Acres		
Less than 1,500 board feet	6,997	146,847	153,844
1,500 to 4,999 board feet	8,325	178,064	186,389
5,000 to 9,999 board feet	6,811	135,711	142,522
10,000 board feet or more	4,958	98,584	103,542
All classes	27,091	559,206	586,297

[1]International 1/4-inch rule.

Table 9.--*Area of commercial timberland in the Bozeman Working Circle by forest type and area condition class; State and private, 1976*

Forest type	Area condition class									Nonstocked	All classes	
	10	20	30	40	50	60	70	80	90			
	Acres											*Hectares*
Douglas-fir	--	--	--	23,017	29,802	129,785	59,544	--	79,013	3,871	325,032	131,536
Ponderosa pine	--	--	--	--	--	--	3,875	3,744	7,284	--	14,903	6,031
Lodgepole pine	--	3,836	3,871	7,707	30,778	18,833	11,689	3,744	21,618	11,098	113,174	45,800
Whitebark-limber pine	--	--	--	--	--	3,665	7,636	--	14,364	--	25,665	10,386
Spruce-subalpine fir	--	--	3,836	3,744	7,865	14,948	3,870	10,902	22,119	3,871	71,155	28,796
Juniper	--	--	--	--	--	7,313	--	--	--	--	7,313	2,960
Total softwoods	--	3,836	7,707	34,468	68,445	174,544	86,614	18,390	144,398	18,840	557,242	225,509
Aspen	--	--	--	--	3,512	11,171	7,348	--	--	-	22,031	8,916
Cottonwood	--	--	--	--	--	3,512	3,512	--	--	--	7,024	2,842
Total hardwoods	--	--	--	--	3,512	14,683	10,860	--	--	--	29,055	11,758
All types	--	3,836	7,707	34,468	71,957	189,227	97,474	18,390	144,398	18,840	586,297	237,267

Table 10.--*Area of unproductive nonreserved forest land in the Bozeman Working Circle by forest type and ownership class, 1976*

Forest type	Ownership class					
	State		Private		State and private	
	Acres	Hectares	Acres	Hectares	Acres	Hectares
Douglas-fir	827	335	14,378	5,818	15,205	6,153
Ponderosa pine	486	197	7,150	2,893	7,636	3,090
Lodgepole pine	242	98	3,502	1,417	3,744	1,515
Whitebark-limber pine	376	152	7,050	2,853	7,426	3,005
Juniper	163	66	3,501	1,417	3,664	1,483
Mixed softwoods	260	105	6,888	2,788	7,148	2,893
Aspen	330	133	7,079	2,865	7,409	2,998
Cottonwood	520	210	6,503	2,632	7,023	2,842
Mixed hardwoods	622	252	11,102	4,493	11,724	4,745
All types	3,826	1,548	67,153	27,176	70,979	28,724

Table 11.--*Number of growing stock trees on commercial timberland in the Bozeman Working Circle by species and diameter class; State and private, 1976*

Species	Diameter class (inches at breast height)															
	1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+	All classes
	Thousand trees															
Douglas-fir	5,678	7,598	12,710	13,859	9,445	5,369	2,946	1,628	871	413	207	126	74	24	125	61,073
Ponderosa pine	219	349	271	484	215	173	82	88	54	20	11	6	4	--	9	1,985
Lodgepole pine	5,127	8,664	7,608	7,798	4,385	1,604	744	269	156	49	23	--	--	--	--	36,427
Whitebark-limber pine	345	1,347	1,591	1,541	1,022	803	361	266	59	34	35	4	--	--	--	7,408
Subalpine fir	10,367	4,937	4,190	2,645	1,024	496	144	75	26	7	5	--	8	--	--	23,924
Engelmann spruce	2,097	1,600	1,153	1,168	879	569	425	292	89	108	58	47	--	14	10	8,509
Juniper	1,455	2,226	636	85	21	39	--	10	--	--	--	--	5	--	--	4,477
Total softwoods	25,288	26,721	28,159	27,580	16,991	9,053	4,702	2,628	1,255	631	339	183	91	38	144	143,803
Aspen	118	780	1,139	927	417	203	39	--	--	--	--	--	--	--	--	3,623
Other hardwoods	--	105	57	193	264	35	63	20	8	14	11	9	4	4	5	792
Total hardwoods	118	885	1,196	1,120	681	238	102	20	8	14	11	9	4	4	5	4,415
All species	25,406	27,606	29,355	28,700	17,672	9,291	4,804	2,648	1,263	645	350	192	95	42	149	148,218

Table 12.--*Number of cull and salvable dead trees on commercial timberland in the Bozeman Working Circle by ownership class, and softwoods and hardwoods, 1976*

Ownership class and species group	Cull trees			Salvable dead trees
	Sound	Rotten	Total	
	Thousand trees			
State:				
Softwoods	1,769	51	1,820	569
Hardwoods	140	14	154	34
Total	1,909	65	1,974	603
Private:				
Softwoods	38,477	957	39,434	12,561
Hardwoods	2,401	235	2,636	476
Total	40,878	1,192	42,070	13,037
State and private:				
Softwoods	40,246	1,008	41,254	13,130
Hardwoods	2,541	249	2,790	510
Total	42,787	1,257	44,044	13,640

Table 13.--*Net volume of growing stock on commercial timberland in the Bozeman Working Circle by ownership class, forest type, and stand-size class, 1976*

Ownership class	Forest type	Stand-size class				All classes	
		Sawtimber	Poletimber	Sapling/seedling	Nonstocked		
		Thousand cubic feet					*Thousand cubic meters*
State:							
	Douglas-fir	18,848	2,848	64	--	21,760	617
	Ponderosa pine	393	--	--	--	393	11
	Lodgepole pine	6,967	3,849	18	41	10,875	308
	Whitebark-limber pine	3,048	--	14	--	3,062	87
	Spruce-subalpine fir	5,509	311	151	--	5,971	169
	Juniper	35	--	3	--	38	1
	Aspen	--	924	319	--	1,243	35
	Cottonwood	280	189	--	--	469	13
	All types	35,080	8,121	569	41	43,811	1,241
Private:							
	Douglas-fir	386,081	63,999	2,107	--	452,187	12,804
	Ponderosa pine	10,895	--	--	--	10,895	309
	Lodgepole pine	138,218	72,992	3,045	886	215,141	6,092
	Whitebark-limber pine	56,029	--	291	--	56,320	1,594
	Spruce-subalpine fir	112,558	10,402	3,941	940	127,841	3,620
	Juniper	2,431	--	69	--	2,500	71
	Aspen	--	11,552	4,083	--	15,635	443
	Cottonwood	3,493	2,367	--	--	5,860	166
	All types	709,705	161,312	13,536	1,826	886,379	25,099
State and private:							
	Douglas-fir	404,929	66,847	2,171	--	473,947	13,421
	Ponderosa pine	11,288	--	--	--	11,288	320
	Lodgepole pine	145,185	76,841	3,063	927	226,016	6,400
	Whitebark-limber pine	59,077	--	305	--	59,382	1,681
	Spruce-subalpine fir	118,067	10,713	4,092	940	133,812	3,789
	Juniper	2,466	--	72	--	2,538	72
	Aspen	--	12,476	4,402	--	16,878	478
	Cottonwood	3,773	2,556	--	--	6,329	179
	All types	744,785	169,433	14,105	1,867	930,190	26,340

Table 14.--*Net volume of sawtimber on commercial timberland in the Bozeman Working Circle by ownership class, forest type, and stand-size class, 1976*

Ownership class	Forest type	Stand-size class				All classes
		Sawtimber	Poletimber	Sapling/seedling	Nonstocked	
		Thousand board feet[1]				
State:						
	Douglas-fir	73,626	4,343	141	--	78,110
	Ponderosa pine	1,540	--	--	--	1,540
	Lodgepole pine	26,347	4,126	52	126	30,651
	Whitebark-limber pine	10,810	--	39	--	10,849
	Spruce-subalpine fir	21,036	731	469	--	22,236
	Juniper	85	--	2	--	87
	Aspen	--	657	1,487	--	2,144
	Cottonwood	723	458	--	--	1,181
	All types	134,167	10,315	2,190	126	146,798
Private:						
	Douglas-fir	1,491,894	98,531	6,278	--	1,596,703
	Ponderosa pine	42,945	--	--	--	42,945
	Lodgepole pine	509,264	76,468	986	2,698	589,416
	Whitebark-limber pine	200,787	--	844	--	201,631
	Spruce-subalpine fir	430,699	24,476	12,204	3,762	471,141
	Juniper	5,942	--	39	--	5,981
	Aspen	--	8,203	19,073	--	27,276
	Cottonwood	9,031	5,726	--	--	14,757
	All types	2,690,562	213,404	39,424	6,460	2,949,850
State and private:						
	Douglas-fir	1,565,520	102,874	6,419	--	1,674,813
	Ponderosa pine	44,485	--	--	--	44,485
	Lodgepole pine	535,611	80,594	1,038	2,824	620,067
	Whitebark-limber pine	211,597	--	883	--	212,480
	Spruce-subalpine fir	451,735	25,207	12,673	3,762	493,377
	Juniper	6,027	--	41	--	6,068
	Aspen	--	8,860	20,560	--	29,420
	Cottonwood	9,754	6,184	--	--	15,938
	All types	2,824,729	223,719	41,614	6,586	3,096,648

[1]International 1/4-inch rule.

Table 15.--*Net volume of growing stock on commercial timberland in the Bozeman Working Circle by species and diameter class; State and private, 1976*

Species	Diameter class (inches at breast height)													
	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+	All classes
	Thousand cubic feet													
Douglas-fir	34,167	70,846	82,379	71,410	55,626	41,213	28,434	17,004	10,662	7,584	5,275	2,217	15,752	442,569
Ponderosa pine	420	2,036	1,706	2,119	1,593	2,269	1,854	1,061	489	313	295	--	1,082	15,237
Lodgepole pine	38,883	69,563	62,576	33,494	21,928	9,494	7,163	2,501	1,492	--	--	--	--	247,094
Whitebark-limber pine	5,422	10,818	10,411	13,161	7,675	7,771	2,053	1,743	1,728	239	--	--	--	61,021
Subalpine fir	16,168	17,420	11,447	7,927	3,379	2,276	1,039	377	291	--	536	--	--	60,860
Engelmann spruce	4,187	7,687	9,746	10,962	11,808	10,402	4,117	6,742	4,222	4,289	--	1,739	1,607	77,508
Juniper	305	148	95	210	--	136	--	--	--	--	15	--	--	909
Total softwoods	99,552	178,518	178,360	139,283	102,009	73,561	44,660	29,428	18,884	12,425	6,121	3,956	18,441	905,198
Aspen	3,501	6,123	4,165	2,862	801	--	--	--	--	--	--	--	--	17,452
Cottonwood	108	890	1,983	433	1,003	613	198	420	531	409	279	211	462	7,540
Total hardwoods	3,609	7,013	6,148	3,295	1,804	613	198	420	531	409	279	211	462	24,992
All species	103,161	185,531	184,508	142,578	103,813	74,174	44,858	29,848	19,415	12,834	6,400	4,167	18,903	930,190

Table 16.--*Net volume of sawtimber on commercial timberland in the Bozeman Working Circle by species and diameter class; State and private, 1976*

Species	Diameter class (inches at breast height)													
	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+	All classes
	Thousand board feet, International 1/4-inch rule											
Douglas-fir	285,937	329,895	280,334	217,482	154,290	94,016	59,722	42,686	29,770	12,685	90,995	1,597,812
Ponderosa pine	4,983	8,639	7,725	11,690	9,815	5,539	2,943	1,703	1,589	--	5,519	60,145
Lodgepole pine	255,959	194,256	125,789	53,161	39,265	13,558	8,145	--	--	--	--	690,133
Whitebark-limber pine	43,320	75,873	43,719	43,321	11,165	9,443	9,384	1,319	--	--	--	237,544
Subalpine fir	44,229	41,322	17,793	11,904	5,411	1,968	1,528	--	3,016	--	--	127,171
Engelmann spruce	40,480	59,780	63,973	55,565	21,774	35,358	22,201	23,243	--	10,054	9,611	342,039
Juniper	286	628	--	385	--	--	--	--	41	--	--	1,340
Total softwoods	675,194	710,393	539,333	393,508	241,720	159,882	103,923	68,951	34,416	22,739	106,125	3,056,184
Aspen	0	14,684	4,102	--	--	--	--	--	--	--	--	18,786
Cottonwood	0	2,188	5,007	3,030	949	1,972	2,422	1,822	1,250	938	2,100	21,678
Total hardwoods	0	16,872	9,109	3,030	949	1,972	2,422	1,822	1,250	938	2,100	40,464
All species	675,194	727,265	548,442	396,538	242,669	161,854	106,345	70,773	35,666	23,677	108,225	3,096,648

Table 17.--*Net volume of growing stock and sawtimber on commercial timberland in the Bozeman Working Circle by ownership class and species, 1976*

Ownership class	Species											
	Douglas-fir	Ponderosa pine	Lodgepole pine	Whitebark-limber pine	Subalpine fir	Engelmann spruce	Juniper	Total softwoods	Aspen	Cottonwood	Total hardwoods	All species
	GROWING STOCK *Thousand cubic feet*											
State	20,206	504	11,819	3,005	2,877	3,677	21	42,109	1,181	521	1,702	43,811
Private	422,363	14,733	235,275	58,016	57,983	73,831	888	863,089	16,271	7,019	23,290	886,379
Total	442,569	15,237	247,094	61,021	60,860	77,508	909	905,198	17,452	7,540	24,992	930,190
	GROWING STOCK *Thousand cubic meters*											
State	572	14	335	85	81	104	1	1,192	34	15	49	1,241
Private	11,960	417	6,662	1,643	1,642	2,091	25	24,440	460	199	659	25,099
Total	12,532	431	6,997	1,728	1,723	2,195	26	25,632	494	214	708	26,340
	SAWTIMBER *Thousand board feet, International 1/4-inch rule*											
State	74,413	1,975	33,960	11,496	6,147	16,171	21	144,183	1,189	1,426	2,615	146,798
Private	1,523,399	58,170	656,173	226,048	121,024	325,868	1,319	2,912,001	17,597	20,252	37,849	2,949,850
Total	1,597,812	60,145	690,133	237,544	127,171	342,039	1,340	3,056,184	18,786	21,678	40,464	3,096,648

Table 18.--*Net volume of timber on commercial timberland in the Bozeman Working Circle by class of timber, and softwoods and hardwoods; State and private, 1976*

Class of timber	Softwoods	Hardwoods	All classes
	Thousand cubic feet		
Sawtimber trees:			
Saw-log portion	552,660	6,276	558,936
Upper-stem portion	74,468	1,946	76,414
Total	627,128	8,222	635,350
Poletimber trees	278,070	16,770	294,840
All growing stock trees	905,198	24,992	930,190
Sound cull trees	24,825	1,455	26,280
Rotten cull trees	2,959	162	3,121
Salvable dead trees	71,869	1,881	73,750
All timber	1,004,851	28,490	1,033,341

Table 19.--*Net volume of growing stock on commercial timberland in the Bozeman Working Circle by forest type and species; State and private, 1976*

Forest type	Species											All species	
	Douglas-fir	Ponderosa pine	Lodgepole pine	Whitebark-limber pine	Subalpine fir	Engelmann spruce	Juniper	Total softwoods	Aspen	Cottonwood	Total hardwoods		
	Thousand cubic feet												*Thousand cubic meters*
Douglas-fir	417,655	4,197	36,888	6,828	1,514	2,490	163	469,735	4,212	--	4,212	473,947	13,421
Ponderosa pine	248	11,040	--	--	--	--	--	11,288	--	--	--	11,288	320
Lodgepole pine	10,926	--	191,239	4,975	11,548	7,102	--	225,790	226	--	226	226,016	6,400
Whitebark-limber pine	2,655	--	4,892	32,584	9,800	9,451	--	59,382	--	--	--	59,382	1,681
Spruce-subalpine fir	6,556	--	13,486	16,634	37,998	57,927	--	132,601	--	1,211	1,211	133,812	3,789
Juniper	1,792	--	--	--	--	--	746	2,538	--	--	--	2,538	72
Aspen	2,737	--	589	--	--	538	--	3,864	13,014	--	13,014	16,878	478
Cottonwood	--	--	--	--	--	--	--	--	--	6,329	6,329	6,329	179
All types	442,569	15,237	247,094	61,021	60,860	77,508	909	905,198	17,452	7,540	24,992	930,190	26,340
	Thousand cubic meters												
All types	12,532	431	6,997	1,728	1,723	2,195	26	25,632	494	214	708	--	26,340

Table 21.--*Net volume of sawtimber on commercial timberland in the Bozeman Working Circle by forest type and species; State and private; 1976*

Forest type	Species											
	Douglas-fir	Ponderosa pine	Lodgepole pine	Whitebark-limber pine	Subalpine fir	Engelmann spruce	Juniper	Total softwoods	Aspen	Cottonwood	Total hardwoods	All species
	Thousand board feet, International 1/4-inch rule											
Douglas-fir	1,497,572	16,814	116,018	17,417	7,959	9,789	--	1,665,569	9,244	--	9,244	1,674,813
Ponderosa pine	1,154	43,331	--	--	--	--	--	44,485	--	--	--	44,485
Lodgepole pine	36,425	--	515,162	18,756	16,589	33,135	--	620,067	--	--	--	620,067
Whitebark-limber pine	13,340	--	19,254	130,884	17,471	31,531	--	212,480	--	--	--	212,480
Spruce-subalpine fir	30,854	--	36,422	70,487	85,152	264,722	--	487,637	--	5,740	5,740	493,377
Juniper	4,728	--	--	--	--	--	1,340	6,068	--	--	--	6,068
Aspen	13,739	--	3,277	--	--	2,862	--	19,878	9,542	--	9,542	29,420
Cottonwood	--	--	--	--	--	--	--	--	--	15,938	15,938	15,938
All types	1,597,812	60,145	690,133	237,544	127,171	342,039	1,340	3,056,184	18,786	21,678	40,464	3,096,648

Table 20.--*Net annual growth of growing stock and sawtimber on commercial timberland in the Bozeman Working Circle by ownership class and species, 1976*

Ownership class	Species										
	Douglas-fir	Ponderosa pine	Lodgepole pine	Whitebark-limber pine	Subalpine fir	Engelmann spruce	Total softwoods	Aspen	Cottonwood	Total hardwoods	All species
	GROWING STOCK *Cubic feet*										
State	329,778	11,101	73,005	40,858	41,955	38,052	534,749	21,136	15,344	36,480	571,229
Private	6,778,305	281,597	1,404,056	825,824	960,636	825,190	11,075,608	361,315	162,572	523,887	11,599,495
Total	7,108,083	292,698	1,477,061	866,682	1,002,591	863,242	11,610,357	382,451	177,916	560,367	12,170,724
	GROWING STOCK *Cubic meters*										
State	9,338	314	2,068	1,157	1,188	1,077	15,142	599	434	1,033	16,175
Private	191,940	7,974	39,758	23,385	27,202	23,367	313,626	10,231	4,604	14,835	328,461
Total	201,278	8,288	41,826	24,542	28,390	24,444	328,768	10,830	5,038	15,868	344,636
	SAWTIMBER *Board feet, International 1/4-inch rule*										
State	2,116,053	51,056	446,577	115,509	38,367	252,041	3,019,603	121,398	9,088	130,486	3,150,089
Private	41,531,104	1,250,863	7,639,784	2,125,074	767,805	5,746,687	59,061,317	1,542,177	-40,391	1,501,786	60,563,103
Total	43,647,157	1,301,919	8,086,361	2,240,583	806,172	5,998,728	62,080,920	1,663,575	-31,303	1,632,272	63,713,192

Table 22.--*Annual mortality of growing stock and sawtimber on commercial timberland in the Bozeman Working Circle by ownership class, and softwoods and hardwoods, 1976*

Species group and ownership class	Growing stock		Sawtimber
	- Cubic feet -	*- Cubic meters -*	*- Board feet*[1] *-*
Softwoods:			
State	256,188	7,254	826,753
Private	5,025,272	142,300	16,680,465
Total	5,281,460	149,554	17,507,218
Hardwoods:			
State	24,244	687	36,355
Private	376,567	10,663	660,059
Total	400,811	11,350	696,414

[1]International 1/4-inch rule.

Table 23.--*Annual mortality of growing stock and sawtimber on commercial timberland in the Bozeman Working Circle by cause of death and species; State and private, 1976*

Cause of death	Species								All species
	Douglas-fir	Lodgepole pine	Subalpine fir	Engelmann spruce	Total softwoods	Aspen	Cottonwood	Total hardwoods	
	GROWING STOCK *Cubic feet*								
Insects	268,064	210,500	284,637	--	763,201	--	--	--	763,201
Disease	74,391	81,537	--	--	155,928	47,164	--	47,164	203,092
Fire	56,997	63,997	--	--	120,994	--	--	--	120,994
Animal	--	--	--	--	--	--	--	--	--
Weather	640,434	725,327	189,275	173,420	1,728,456	--	45,404	45,404	1,773,860
Suppression	220,850	90,568	--	--	311,418	28,349	--	28,349	339,767
Unknown	256,454	1,453,776	339,531	151,702	2,201,463	162,618	117,276	279,894	2,481,357
Logging	--	--	--	--	--	--	--	--	--
Total	1,517,190	2,625,705	813,443	325,122	5,281,460	238,131	162,680	400,811	5,682,271
	GROWING STOCK *Cubic meters*								
Insects	7,591	5,961	8,060	--	21,612	--	--	--	21,612
Disease	2,107	2,309	--	--	4,416	1,335	--	1,335	5,751
Fire	1,614	1,812	--	--	3,426	--	--	--	3,426
Animal	--	--	--	--	--	--	--	--	--
Weather	18,135	20,539	5,360	4,910	48,944	--	1,286	1,286	50,230
Suppression	6,253	2,565	--	--	8,818	803	--	803	9,621
Unknown	7,262	41,166	9,614	4,296	62,338	4,605	3,321	7,926	70,264
Logging	--	--	--	--	--	--	--	--	--
Total	42,962	74,352	23,034	9,206	149,554	6,743	4,607	11,350	160,904
	SAWTIMBER *Board feet, International 1/4-inch rule*								
Insects	797,525	820,142	965,244	--	2,582,911	--	--	--	2,582,911
Disease	137,643	244,952	--	--	382,595	--	--	--	382,595
Fire	--	192,183	--	--	192,183	--	--	--	192,183
Animal	--	--	--	--	--	--	--	--	--
Weather	2,776,926	1,799,923	624,475	927,333	6,128,657	--	210,098	210,098	6,338,755
Suppression	155,419	--	--	--	155,419	--	--	--	155,419
Unknown	1,206,654	6,044,033	--	814,766	8,065,453	--	486,316	486,316	8,551,769
Logging	--	--	--	--	--	--	--	--	--
Total	5,074,167	9,101,233	1,589,719	1,742,099	17,507,218	--	696,414	696,414	18,203,632

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Headquarters for the Intermountain Forest and Range Experiment Station are in Ogden, Utah. Field programs and research work units are maintained in:

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Logan, Utah (in cooperation with Utah State University)
Missoula, Montana (in cooperation with University of Montana)
Moscow, Idaho (in cooperation with the University of Idaho)
Provo, Utah (in cooperation with Brigham Young University)
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